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VIBRATION TEST OF AN ACA-305 CONTAINER FOR BL-755.(U)
MAR 77 P QUIJAS, E P MORAVEC

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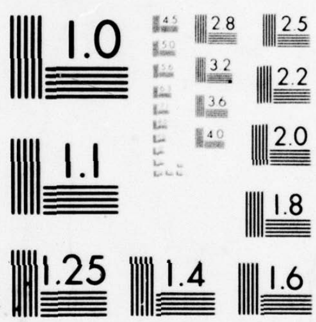

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VIBRATION TEST OF ACA-805

CONTAINER FOR BL-755

AFALD/PTPD
AIR FORCE PACKAGING EVALUATION AGENCY
Wright-Patterson AFB OH 45433

March 1977

See Form 1473

NOTICE

ABSTRACT

An ACA-805 prototype container with an inert BL-755 item was received from ADTC/SDMT, Eglin AFB FL and subjected to the Vibration (Repetitive Shock) Test in accordance with Method 5019 of Federal Test Method Standard (FTMS) No. 101. Prior to vibration, the Vacuum Retention Technique was performed in accordance with Method 5009.1 of FTMS No. 101. The container failed to pass both tests. Vibration (resonance throughout the 3.5 to 4.5 Hertz range) caused failure of the front and rear shock mounting system and collapse/disintegration of the forward sheet metal suspension structure. Some damage was caused to the BL-755 item. It is concluded that the ACA-805 prototype does not meet established requirements and is not suitable for Air Force use.

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INTRODUCTION

PURPOSE: This project was initiated by ADTC/SDMT Eglin AFB FL letter, 8 Feb 1977, requesting the performance of vibration tests (Federal Test Method Standard No. 101, Method 5019) on one all up-round BL-755 seek cluster munition in an ACA-805 container.

The ACA-805 container, Serial No. 1315, with inert BL-755 item aboard, hereafter referred to as the "prototype," was received at the Air Force Packaging Evaluation Agency (AFPEA) on 9 Feb 1977 at which time test set-up preparations and prototype inspection were made and preliminary tests performed. The vibration test was performed on 10 Feb 1977.

DESCRIPTION

DESCRIPTION OF TEST SPECIMEN: The overall dimensions of the prototype were L 108" x W 28 1/2" x H 33". The gross weight of the prototype was 1100 pounds. The net weight of the BL-755 was 605 pounds. A general view of the prototype is shown in Figure 1. An end view of the prototype is shown in Figure 2. The prototype consisted of a metal base with elastic shock mounts and sheetmetal cradles to support the BL-755. A sheet metal cap conforming to the upper half of the BL-755 body was connected to the supporting cradles by means of four adjustable latches on each side. A heavy duty, flexible, rubber-like fabric bag serving as a waterproof barrier was fitted over the BL-755 and was sealed in a groove along the entire perimeter of the base by an air pressure tube integral to the bag. The load was boxed in by a wire cage-like structure and four metal posts fastened to the base.

INSPECTION

INITIAL INSPECTION: During initial prototype inspection, it was noted that the prototype was intact and no external damage had been incurred during shipment (Eglin to AFPEA). The end latches of the wire cage had become unlatched. It was further noted that the wire cage components were tied together by bits of wire at numerous points. Although the cage was somewhat loose, the pins inserted through the lower end of the posts served to hold the cage down.

The left front (front of the prototype being at the nose of the BL-755) corner and right rear corners of the base were bent upward 1 3/8" and 7/8" respectively from floor level. It was learned that these were deformed during cornerwise drop testing at Eglin. The cage was removed and also the bag was removed after releasing an existing tube seal pressure

of about nine pounds per square inch gauge (psig).

The bag appeared to be in satisfactory condition except on the outer upper surface which showed minor abrasion possibly due to intermittent contact with cage top component. The BL-755 item appeared to be in satisfactory condition. The left edge of the front vertical sheetmetal support for the cradle exhibited a slight bow at about midpoint of the vertical edge. It was surmised that this buckling most likely was incurred during the cornerwise drop test at Eglin. All other components such as cradle latches, shock mounts and adjoining structures and fastenings appeared to be satisfactory.

TEST PROCEDURES AND RESULTS

INITIAL TESTS: The preliminary tests consisted of (a) the seal tube pressure test and (b) the rubber-fabric bag vacuum test.

a. The rubber-fabric bag was cleaned off especially in the area of the tube seal. The tube seal groove around the base was also wiped clean to insure an optimum seal. The bag was reinstalled with the seal tube inserted in the groove down to the white line on the bag and the tube seal pressurized to 13 psig. After performance of the vacuum retention technique (described below) the tube seal pressure was rechecked and found unchanged.

NOTE: The satisfactory ability of the seal tube to maintain the required pressure of 13 psig is attested to by the fact that the pressure was not diminished whatsoever by the two-hour vibration test. However, its ability to provide an effective seal is uncertain since it is not known what area of the bag may have caused failure of the vacuum retention test.

b. The vacuum retention technique specified in Method 5009.1 of Federal Test Method Standard No. 101 (FTMS-101) was performed on the sealed rubber bag. The air was evacuated from the bag by means of a Cenco Hyvac vacuum pump, Serial No. 52645, to a reading of five inches H_2O (equivalent to 0.181 psi) on an A-844 Meriam 30" manometer. This vacuum was drawn twice to insure that equilibrium within the bag had been reached.

For preservation Method 11a, MIL-P-116 requires that "A loss of vacuum from the sealed system shall not exceed 25 percent of the original vacuum after remaining undisturbed for 10 minutes." Twenty-five percent (or 1.25 inches H_2O) loss of vacuum occured within two minutes, therefore, the bag is considered to have failed the vacuum retention test.

VIBRATION TEST REQUIREMENTS: The prototype was subjected to Federal Test Method Standard No. 101, Method 5019, Vibration (Repetitive Shock) Test without exception using the option which specifies maximum platform acceleration to be 1 $\pm$ 0.1 times the acceleration of gravity. It was required also that the rubber bag should contain a vacuum of 0.1 psi (or 2.77 inches H_2O) at the instant of test start-up to observe any vibration dampening effect of the bag.

VIBRATION APPARATUS: A L.A.B. Corporation vibration machine, Serial No. 56801, type 5000-96B, which has a frequency servoloop constant displacement cam linked motor drive, was used. The vibration machine's maximum load capacity is 5000 pounds vibrated at 3 Gs peak sinusoidal acceleration from 0 to 40 Hertz (Hz). A 144" x 96" x 1.5" plywood deck was mounted on the 96" x 98" vibration machine table which provided an adequately supported, flat bearing surface for the 1100 pound prototype. Excessive horizontal container motion was limited by barricades nailed to the plywood deck 1/2 inch from the container which was centered on the vibration machine table. Figure 3 shows the prototype mounted on the vibration table.

VIBRATION INSTRUMENTATION: Instrumentation consisted of a tachometer and cam displacement indicator integral to the L.A.B. Corporation vibration machine; a Tektronix Inc., type 564, storage oscilloscope; four Endevco, Model 2233E, piezoelectric accelerometers; four Endevco, Model 2614C, charge amplifiers and an Endevco, Model 2622C, power supply. One accelerometer monitored the vibration machine table vertical acceleration. Three accelerometers in triaxial configuration mounted 5.0 inches to the rear of the NATO shakel lug center monitored the BL-755 item response in the vertical, longitudinal, and transverse directions. For all accelerometers, excessive noise generated by loose hard objects rattling and hammering within the item, and the container impacting on the vibration machine table completely obscurred any useful output.

VIBRATION TESTING: From the instant of vibration start-up it was observed that the rubber bag with vacuum, as required, (see vibration test requirements) did not at any time provide any apparent dampening of item vibration. The container suspension system contained a resonance in the 3.5 - 4.5 Hz region. Location of the item center of gravity above the suspension devices and toward the item nose caused complex container rotation and translation during the bounce portion of the vibration cycle; consequently, use of the 1/16 inch feeler gauge to establish platform acceleration was not possible. Platform acceleration input of 1.08 G was established by adjusting driving frequency to 4.6 Hz with 1.0 inch double amplitude displacement and maintained for the two-hour test period without excessive or violent complex container motion caused by the suspension at frequencies below 4.5 Hz.

VIBRATION TEST RESULTS: As a consequence of the vibration test, several holes were abraded through the rubber bag. There were six holes along the bottom of the bag within 7 1/2 inches from the existing white line; five holes on the right and one on the left side. One other hole was located on the top at the rear of the bag. The largest hole was one by two inches on the right side as illustrated in Figure 4.

The shock suspension and the sheet metal suspension supports failed. The rear sheet metal suspension support was generally shattered, deformed, and near collapse as shown in Figure 5.

The front sheet metal suspension support was completely collapsed so that the left and right vertical shock mount pins had abraded the underside of the cradle and had significantly dented both the cradle and the BL-755 item skin. These conditions are shown in Figures 6 and 7. A general view of the BL-755 and mountings after vibration test is shown in Figure 8. The apparent under design of the suspension structure, the heavy load reaction at this point, and the observed initial buckling (see initial inspection) are considered to be factors contributing to total collapse of the front suspension system. Generally, the rubber in the shear isolation mounts incurred rubber metal bond failure and tearing of the rubber.

The red flagged retainer pin which inserts into the rear of the lower left fin was sheared. It is believed that this allowed only a little more hammering of the fins since there was already some movement prior to vibration with the pin apparently in place. The aluminum tube which protrudes from the tail of the item when the fins are extended, was abraded/cavitated on three quadrants by the hammering action of the fins. Other surface abrasion was noted on the end of the tube. On the lower right quadrant where the tail of the item is joined to the body, several blind rivets failed as evidenced in Figure 9 by the core stems protruding from about 16 of the rivets.

Finally, it is firmly believed that the ends of the cage and possibly the top would have fallen off if the cage components had not been wired together (see initial inspection). The latch and its bracket were broken off from one end of the cage.

CONCLUSIONS AND RECOMMENDATIONS

It is concluded that the ACA-805 prototype does not meet the established requirements and is not suitable for Air Force use. The fins on the BL-755 item are not adequately secured to prevent internal damage during handling and shipment. To preclude movement of the fins it is suggested that the fins be encircled twice around with nylon reinforced pressure-sensitive tape to hold them firmly in place.

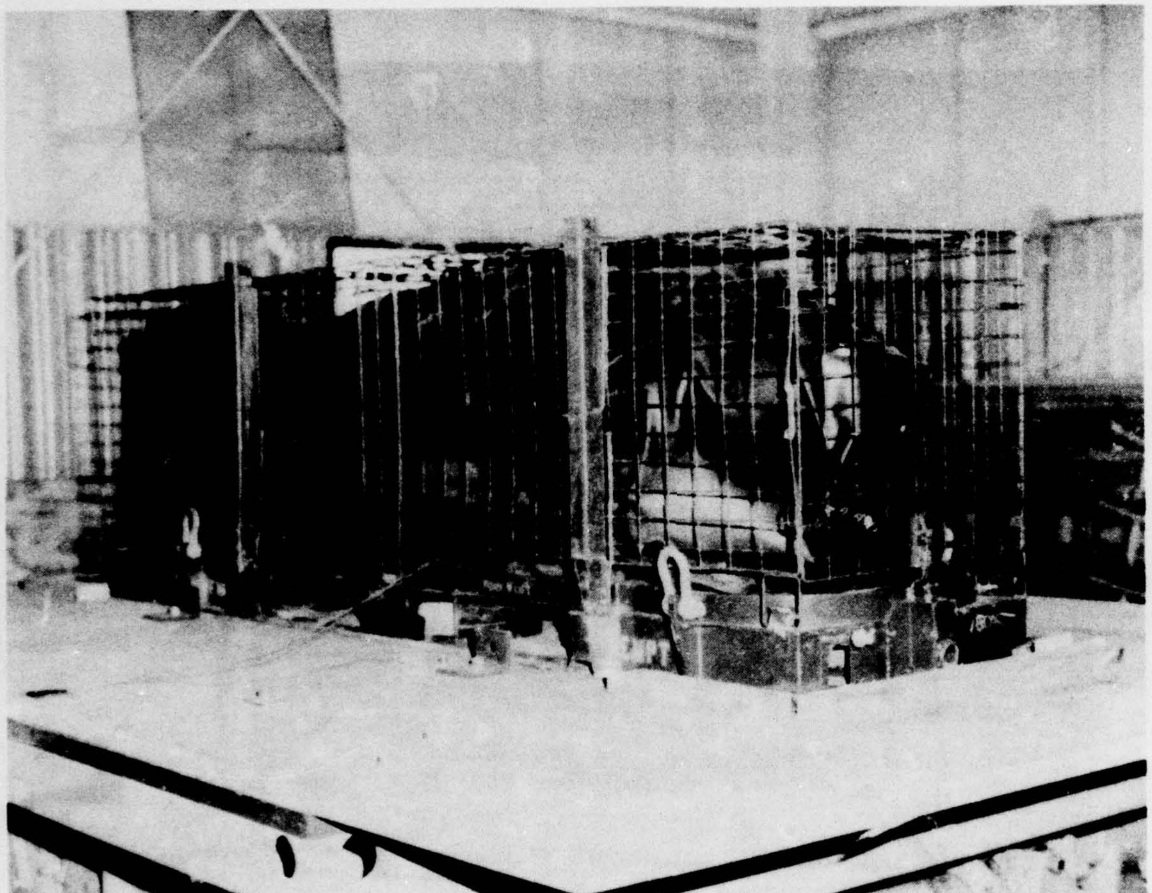

FIGURE 1 - GENERAL VIEW OF ACA-805 CONTAINER

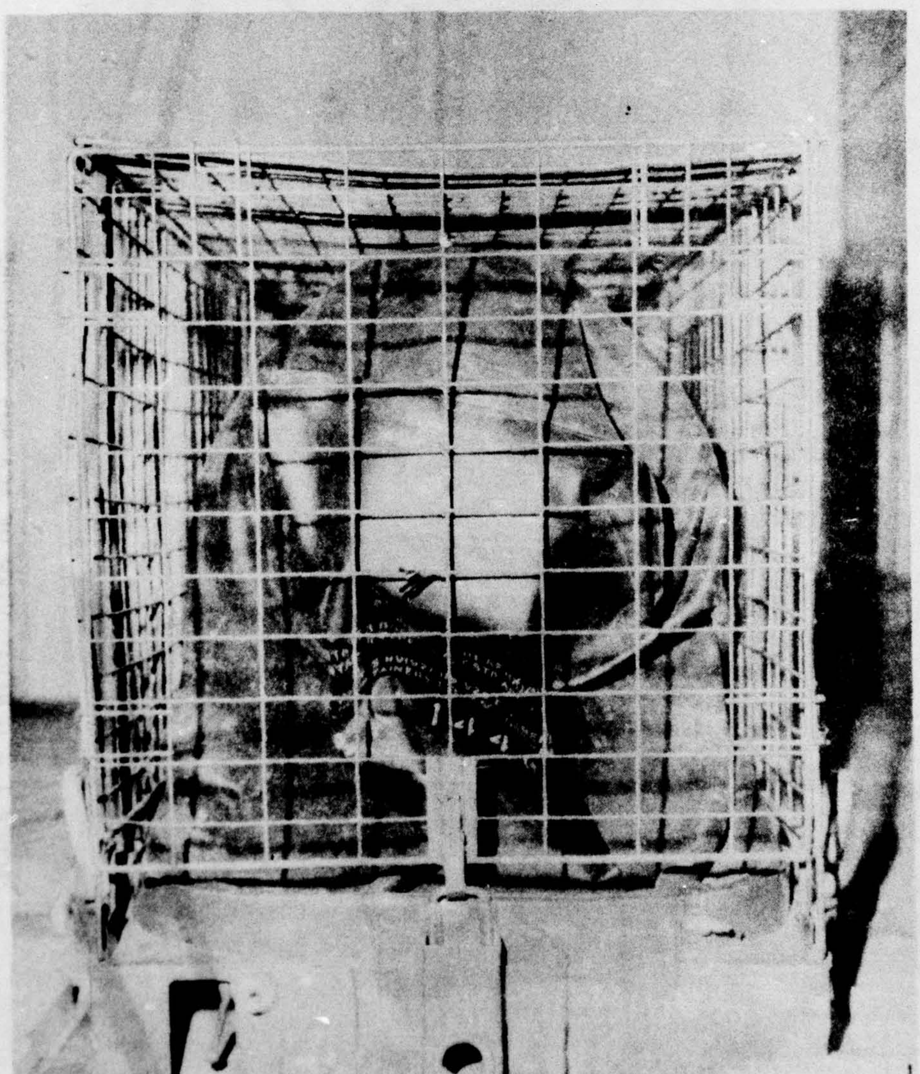

FIGURE 2 - END VIEW OF PROTOTYPE AS RECEIVED

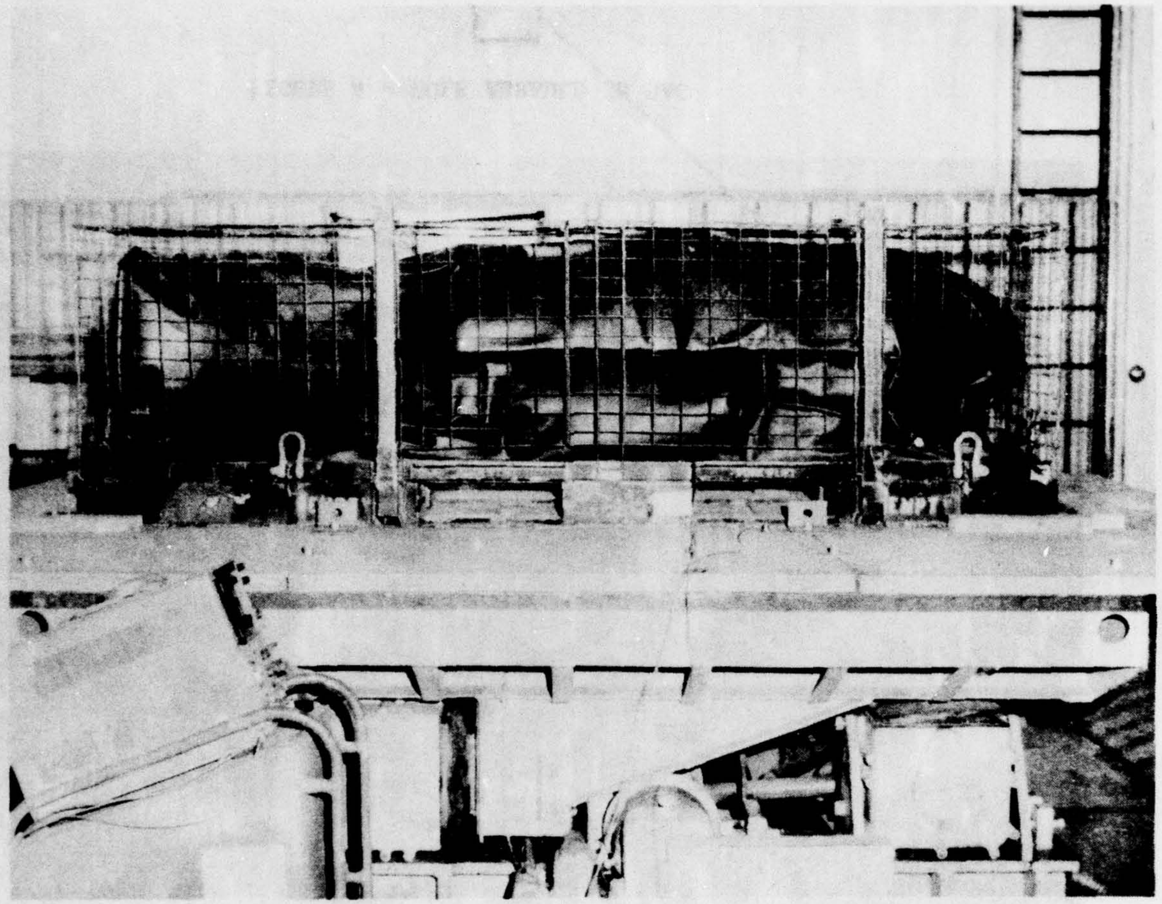

FIGURE 3 - PROTOTYPE ON VIBRATION MACHINE

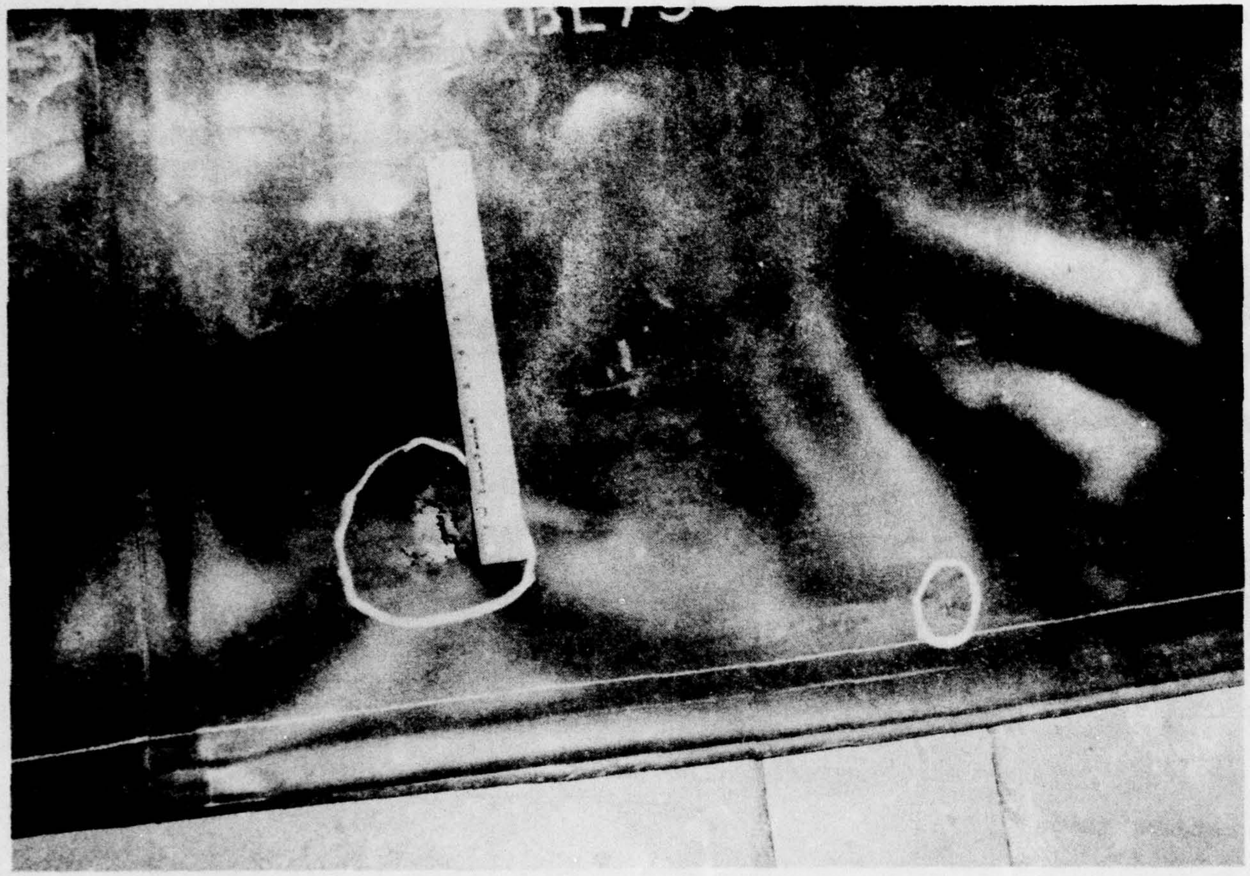

FIGURE 4 - HOLE ABRADED IN BAG

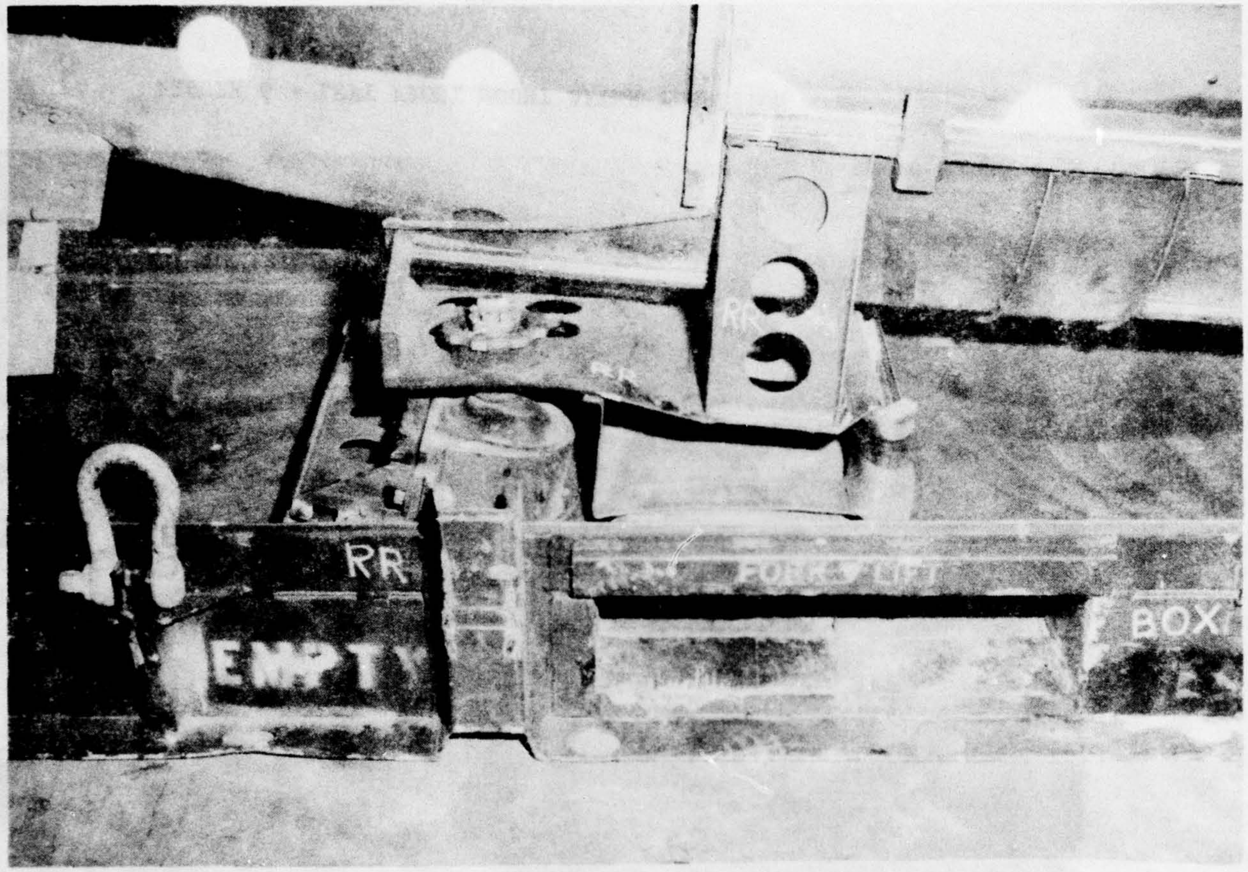

FIGURE 5 - RIGHT REAR MOUNT AFTER VIBRATION

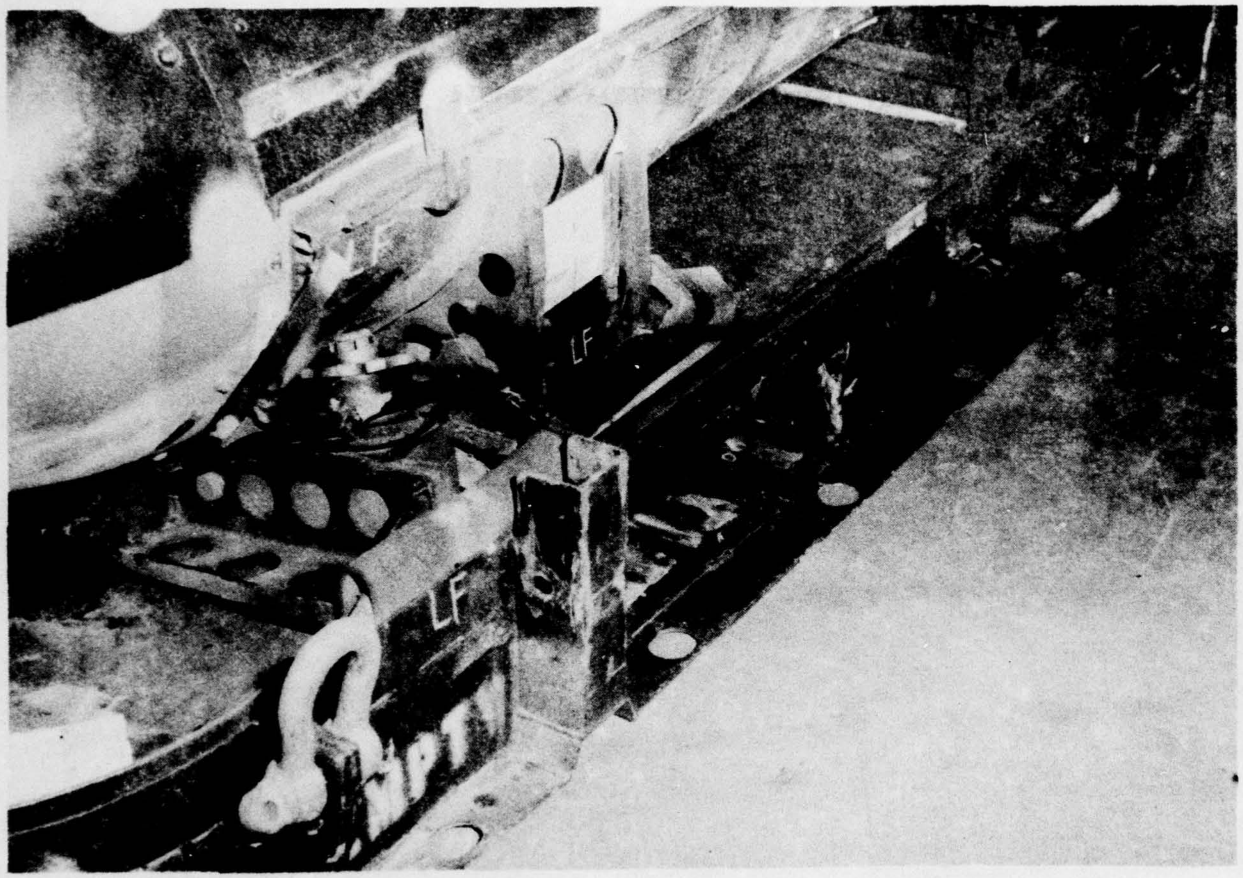

FIGURE 6 - LEFT FRONT MOUNT AFTER VIBRATION

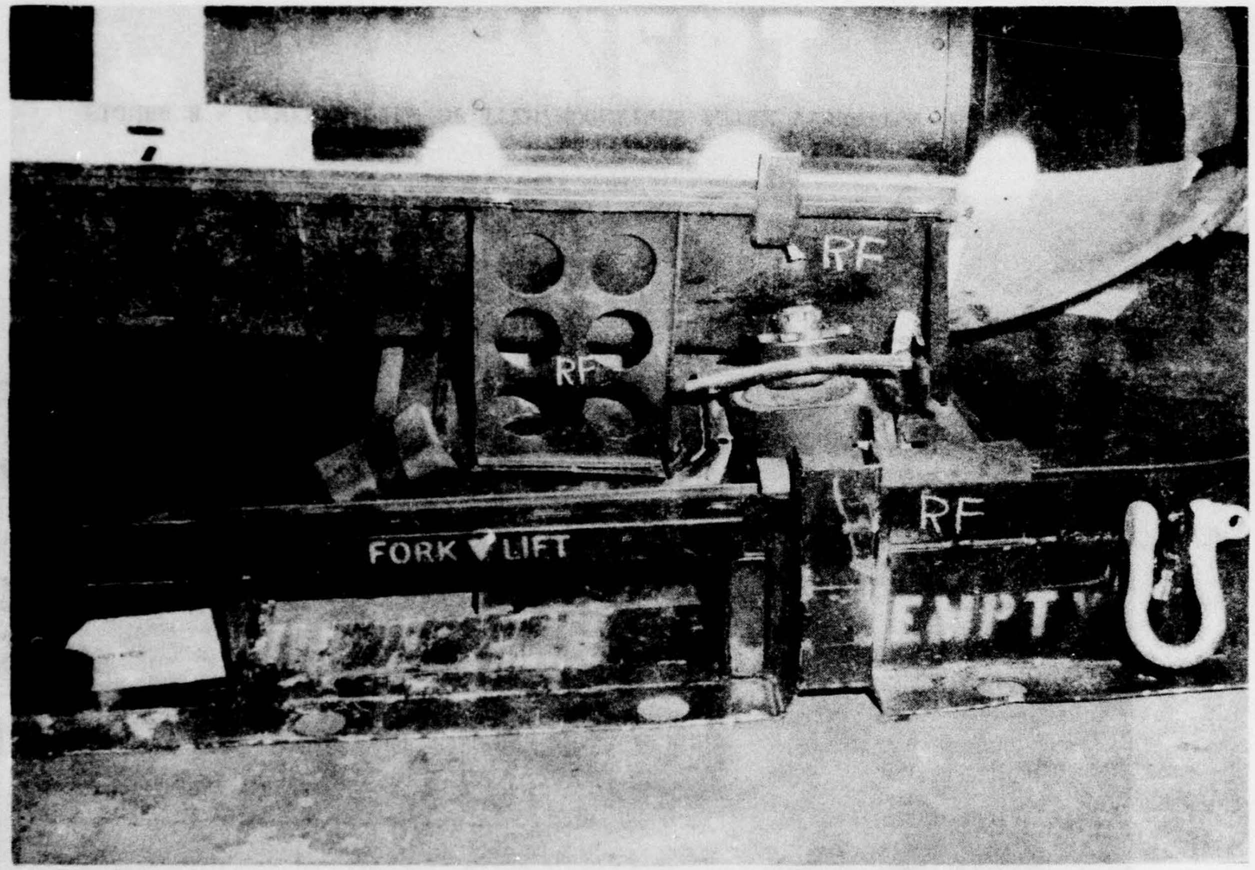

FIGURE 7 - RIGHT FRONT MOUNT AFTER VIBRATION

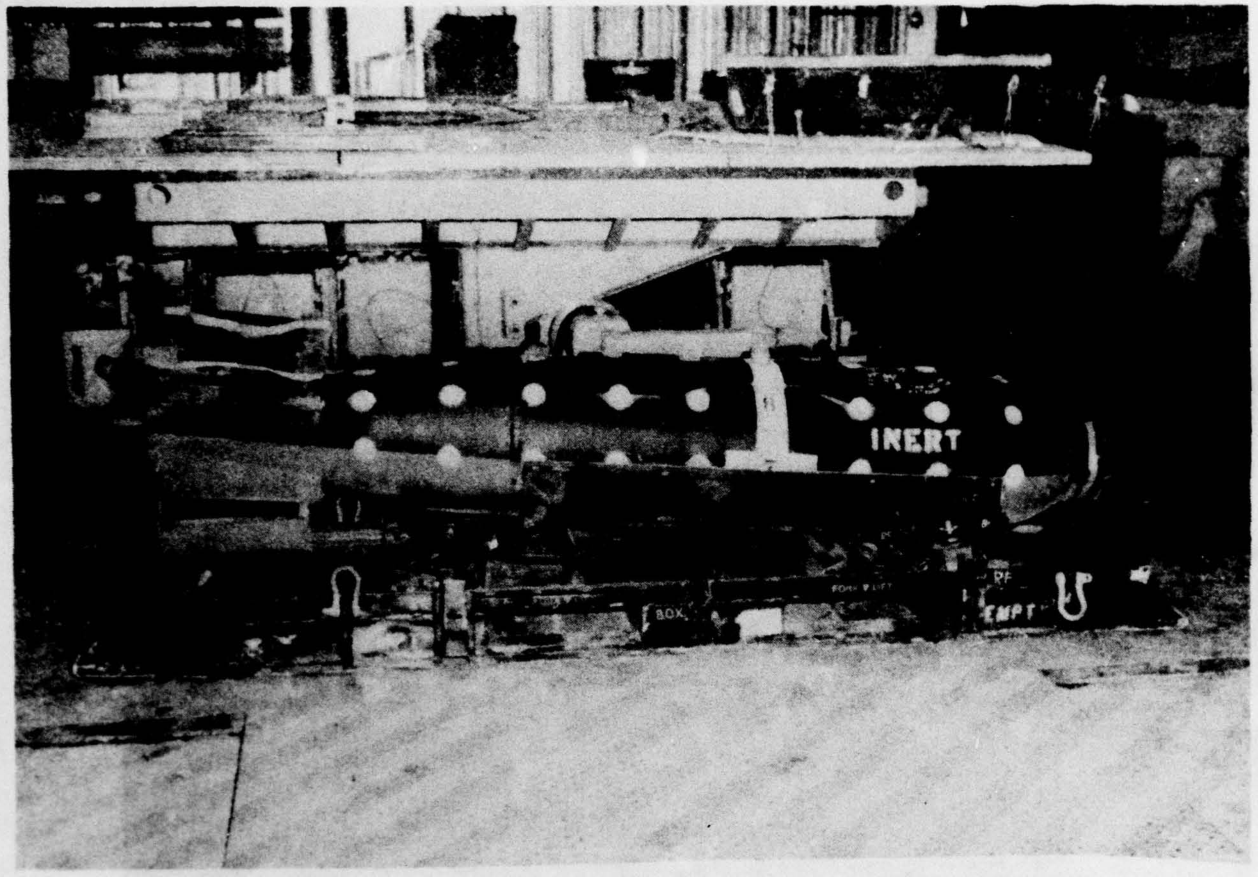

FIGURE 8 - GENERAL VIEW OF ITEM/MOUNTINGS AFTER VIBRATION

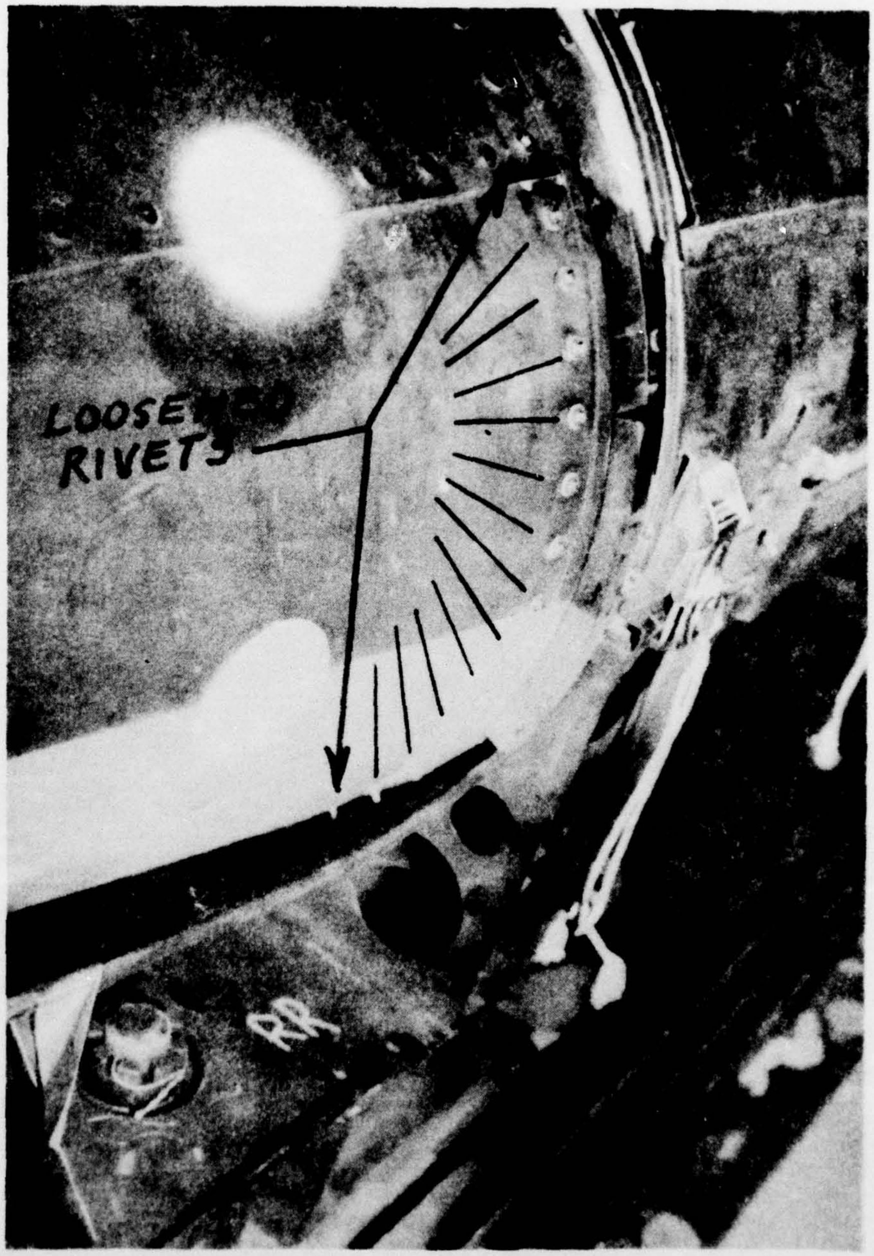

FIGURE 9 - LOOSE RIVETS ON BL-755

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